# Grid-tie Transfomerless Solar Inverter
## RPI H3A / H4A / H5A

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# 1 General Information

## 1.1 Scope of delivery

Congratulations on the purchase of your Delta RPI H3A / H4A / H5A grid-tied solar inverter. This manual assists you in becoming familiar with this product. Please observe all safety regulations and take into account technical connection conditions required at your local grid utility.

## 1.2 General Warnings / Notes on Safety

Careful handling of the product will contribute to service life durability and reliability. Both are essential to ensure maximum yield from your product. As some of the solar inverter models are heavy, two people may be required for lifting purposes.

CAUTION!

During operation of electrical devices, certain parts are under dangerous voltage.

Inappropriate handling can lead to physical injury and material damage.

Always adhere to the installation regulations. Installation may only be conducted by certified electricians.

WARNING!

Repair work on the device should ONLY be carried out by the manufacturer. No user serviceable parts inside.

Please observe all points in the operation and installation manual. Isolate the device from the grid and the PV modules before undertaking work on the device.

DANGER!

To avoid risk of electrical shock, do not open the solar inverter. The inverter contains no user-serviceable parts. Opening the inverter will void the warranty.

Dangerous voltage is present for 5 minutes after disconnecting all sources of power.

Remember that the unit has a high leakage current. The PE conductor MUST be connected prior to commencing operation.

WARNING：BURN HAZARD!

The unit may reach very high temperatures and the device surface can become quite hot. Sufficient cooling is necessary for optimal yield.

## 1.3 Validity

This user manual describes the installation process, maintenance, technical data and safety instructions of the following solar inverter models under the DELTA brand.

- RPI H3A
- RPI H4A
- RPI H5A

## 1.4 Product Description

This device is a single-phase grid-tie solar inverter. It converts direct current (DC) electricity from the PV array into single-phase alternating current (AC) to feed the excess generated power back to the local grid.

This inverter allows for a wide voltage input range (100~550VDC) and has a high performance efficiency and user friendly design and operation. In addition, the special DSP (Digital Signal Processor) design reduces the complexity of the circuit and electronic components. Please note that this device does not support off-grid function. The features for RPI H3A / H4A / H5A are shown below.

**Features**

- Power Rating: 3kVA (RPI H3A), 4kVA (RPI H4A), 5kVA (RPI H5A)
- Single–phase (L + N + PE), Grid-tie, transformerless solar inverter
- Maximum efficiency: >97.5%
- Europe efficiency: 96.8% (RPI H3A) , 97.0%(RPI H4A), 96.8%(RPI H5A)
- Reactive power capability (Cap 0.8 – Ind 0.8)
- Total harmonic distortion (THD < 3%) @ full load
- 2 MPP Trackers
- 16×2 monochrome LCD display

## 1.5 How it Works

The operation of a solar inverter is shown in *Figure 1-1*. In order to save energy and electricity, the solar inverter converts the DC input power supplied from the PV Array into single-phase AC output power to Grid.

*Figure 1-1: Solar system operation illustration*

## 1.6 Additional Information

For more detailed information for RPI H3A/ H4A/ H5A or other related product information, please visit : http://www.deltaww.com.

# 2 Installation and Wiring

## 2.1 Instruction before Installation

Due to the variety of users and installation environments, it is recommended to read this manual thoroughly before installation. Installation of the unit and start-up procedures must be carried out by accredited technicians.

## 2.2 Unpacking

Unpacking process is shown as *Figure 2-1*.

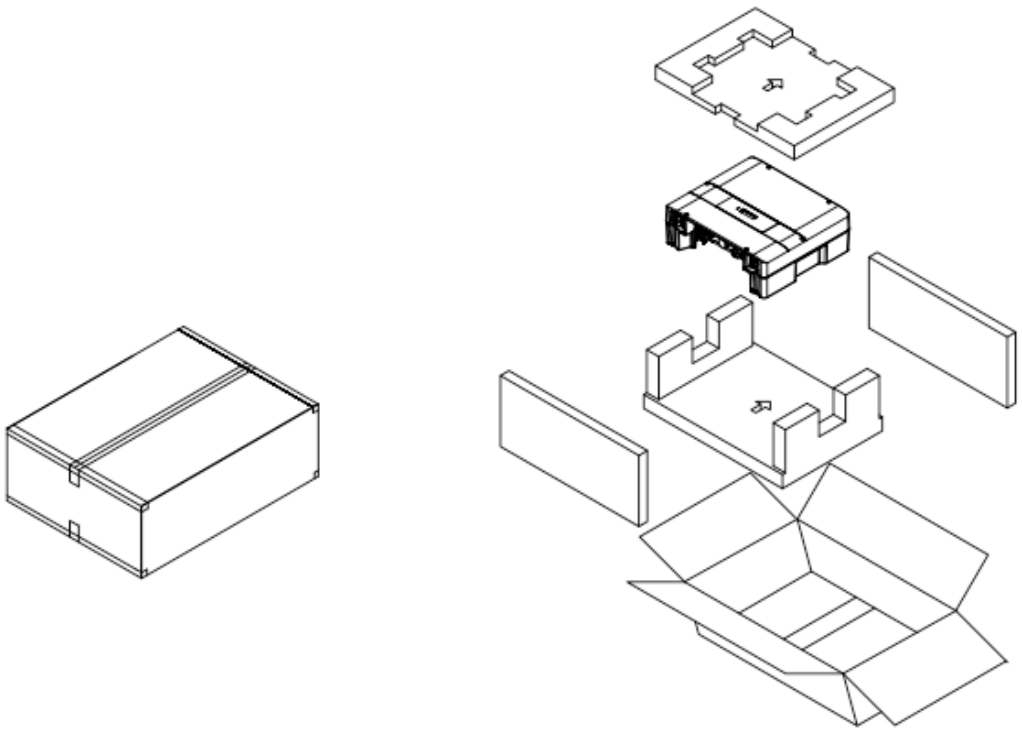


*Figure 2-1: Unpacking process*

Upon receiving your brand new RPI inverter, you will be required to remove its protective packaging. This packaging consists of various materials that will need to be disposed of according to the specific recycling marking printed on them. Please note that cardboard may be recycled, whereas polystyrene foam may not. Please dispose of the packaging materials in a correct manner to ensure a better environment for us all.

## 2.3 Package Inspection

Unforeseeable events causing damage or movement may occur during shipment. Please check for damage on the packaging upon receiving your inverter.

Please check the model number and the serial number on the packaging is identical with the model number and serial number on the unit itself.
Check if all the accessories are in the package, the standard accessories are list as *Table 2-1*:

*Table 2-1: Packing list*

| RPI H3A / H4A /H5A | | |
|---|---|---|
| **Object** | **Qty** | **Description** |
| PV Inverter | 1 | Solar inverter |
| User Manual | 1 | The installation manual is designed to provide information on safety, installation, technical specifications and safe operation of the inverter. |
| AC Plug | 1 | AC Connector plug |
| Wall-Mount Bracket | 1 | Wall-mount bracket to mount the solar inverter securely on the wall |
| M4 Screw | 2 | To fix solar inverter on the bracket |

**Caution: If there is any visible damage to the inverter/accesories or any damageto the packaging, please contact your inverter supplier.**

## 2.4 Identification Label

Users can identify the model number by the information on the product label. The model number, serial number and other specifications can be located on the product label. For label location, please refer to *Figure 2-2*.

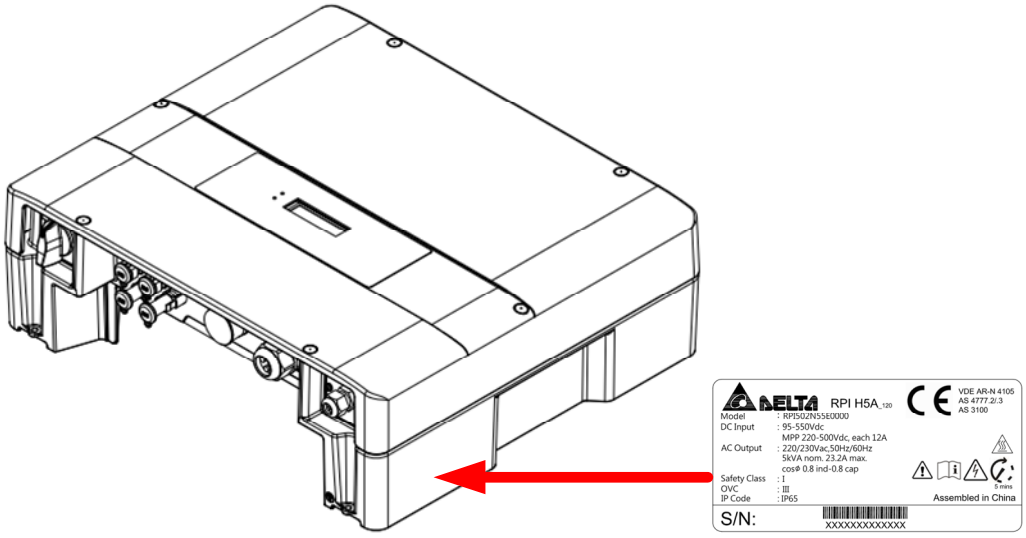



*Figure 2-2: The identification label*

# 3 Product Overview

## 3.1 Dimensions

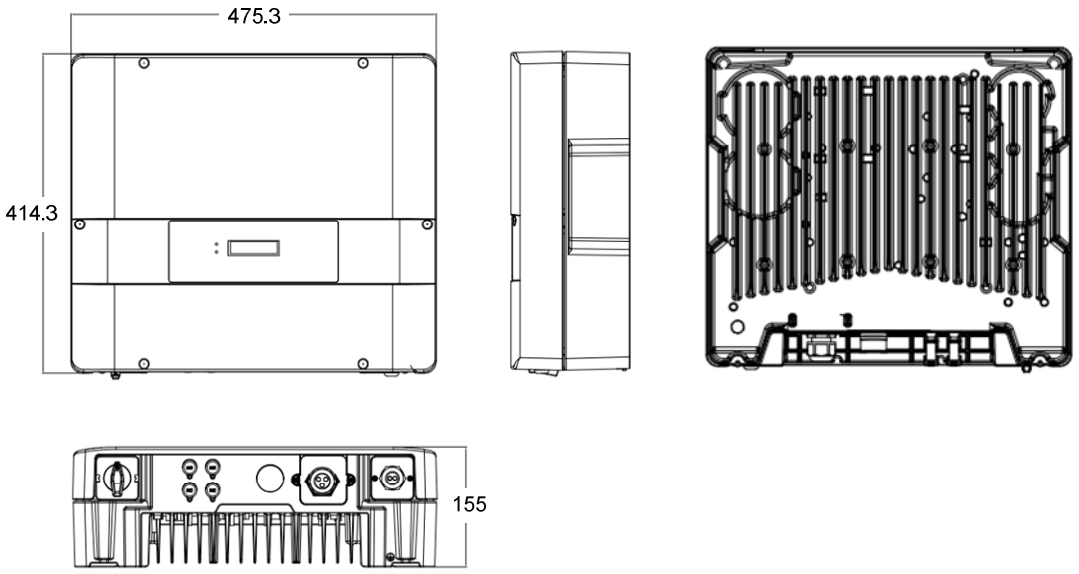



*Figure 3-1: Dimensions of RPI H3A/ H4A/ H5A*

## 3.2 Function Introduction

The Inverter's exterior is shown in *Figure 3-2*. The description for individual objects can be found in sections 3.2.1 and 3.2.2.

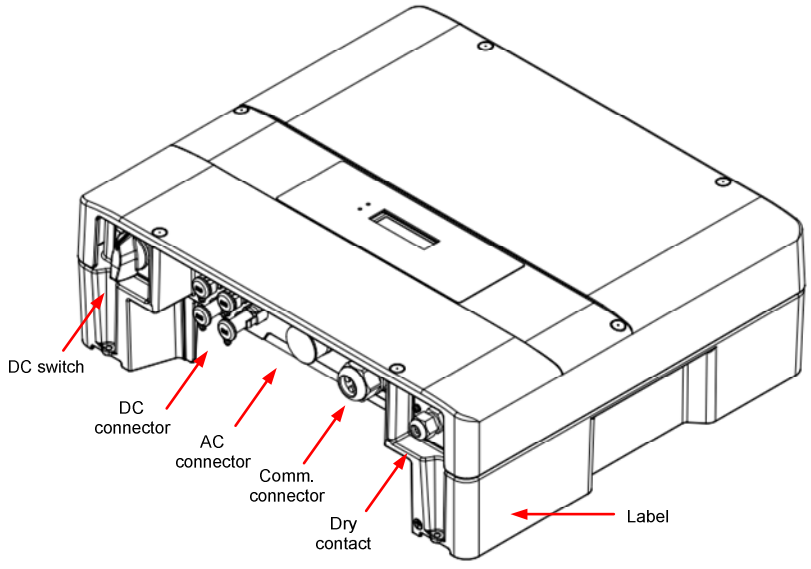



*Figure 3-2: Inverter exterior objects*

### 3.2.1 LCD Display and Buttons

*Figure 3-3: LCD display and buttons*

### 3.2.2 Inverter Input/Output Interface

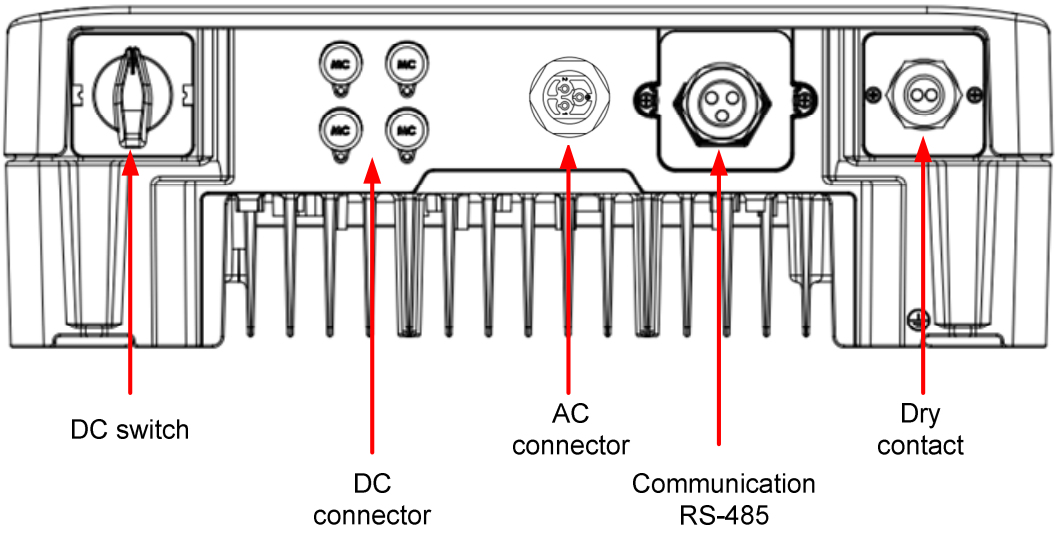



*Figure 3-4: Input/output interface*

**Note**: The DC switch is only presented in the -120 models. Model series -020 does not have the DC switch.

# 4 Installation

## 4.1 Installation Location

WARNING!

Do not install the unit near or on flammable surfaces.
Please mount the unit tightly on a solid/smooth surface

CAUTION!

The unit should not be installed in direct sunlight.

## 4.2 Mounting

This unit is designed to be wall-mounted. Please ensure the installation is perpendicular to the floor and the AC plug located at the base of the unit. Do not install the device on a slanting wall. The dimensions of the mounting bracket are shown in the figure below. 8 of $\varphi$ 5.5mm screws are required for the mounting plate(hole size: $\varphi$ 6.5mm). Fix the supplied wall-mount plate securely on the wall before attaching the inverter onto the mounting plate.

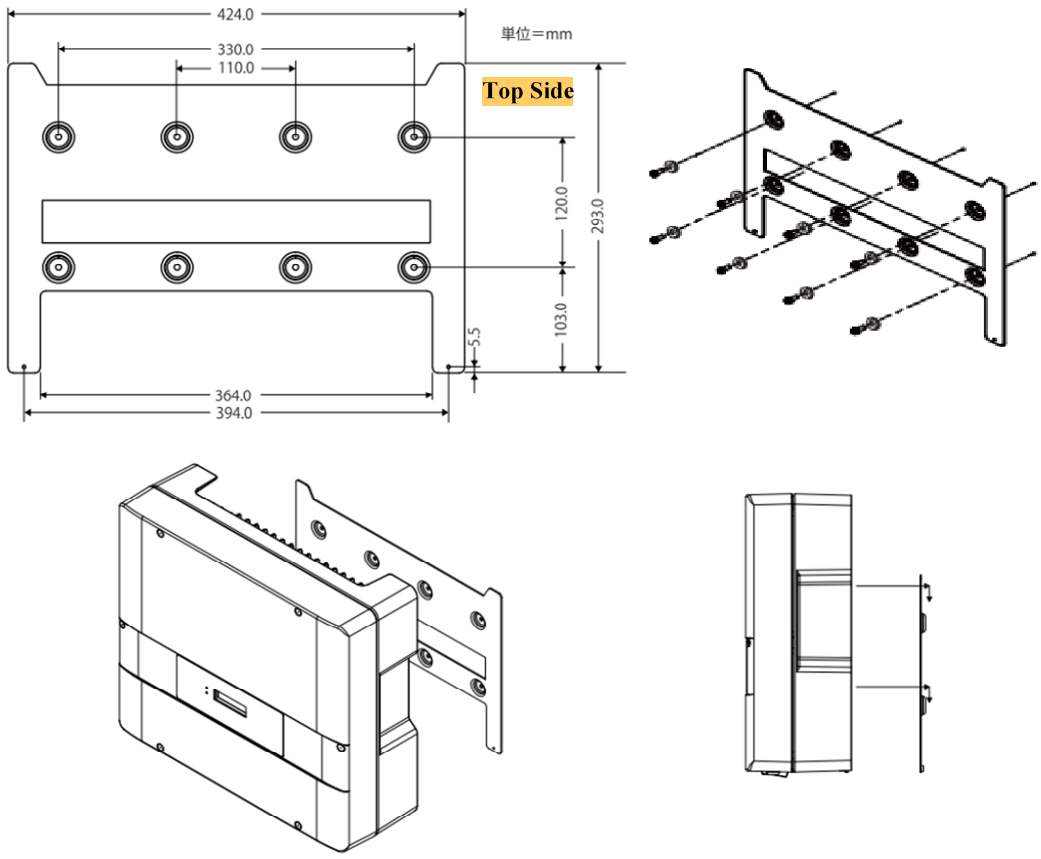



*Figure 4-1: Attaching the mounting bracket for RPI H3A / H4A / H5A*

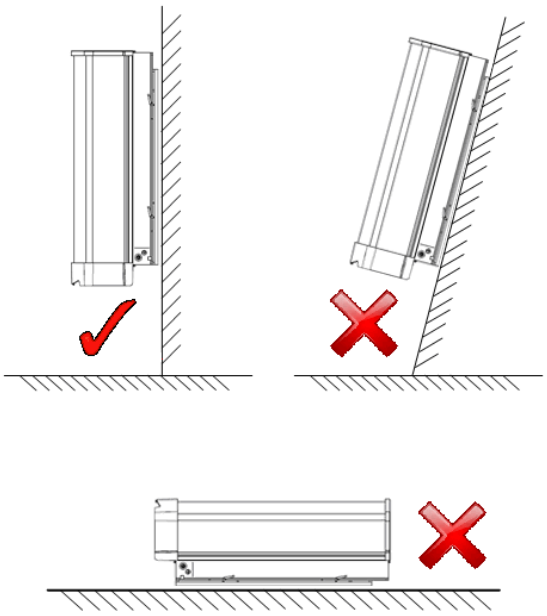


*Figure 4-2: Correct and incorrect installation illustration*

CAUTION!

- The bracket supplied with the unit is specially designed and should be the only mounting device used for the unit.
- It is recommended to install the inverter in a suitable location which offers easy and safe access for service and maintenance.
- Please leave an appropriate gap in between units when installing multiple solar inverter systems.
- Please install solar inverter at eye level to allow easy observation for operation and parameter setting.
- Ambient temperature for operation: -25°C~+60°C (power derating above 40°C).

Please ensure the spacing requirement to allow for sufficient convective cooling. It is essential to ensure sufficient space for product operation as shown in *Figure 4-3*.

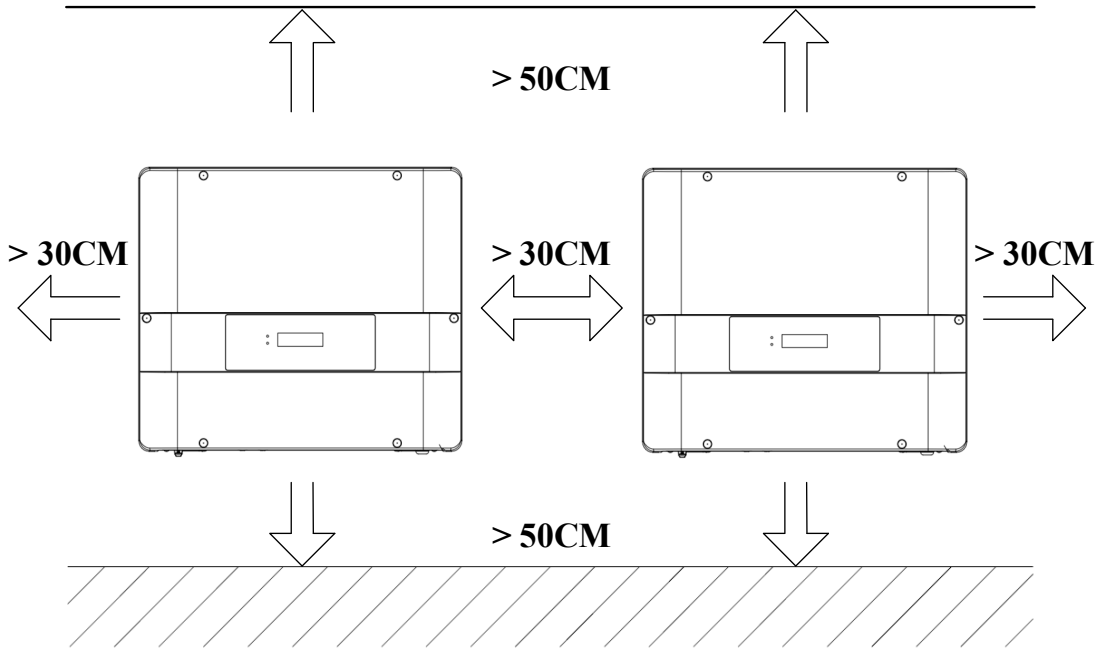



*Figure 4-3: Adequate installation gap*

# 5 Wiring

## 5.1 Preparation before Wiring

1. Ensure voltage values and polarities are correct.
2. When grounding the solar array, an isolation transformer is required due to the RPI H3A / H4A /H5A not having galvanic isolation between the DC-input and AC-output.
3. The ground fault detection is a fixed internal setting. It cannot be modified.
4. Whole system wiring can be seen in *Figure 5-1* and *Figure 5-2*.
5. Please refer to *Figure 5-1* for connections. Inverter can accept DC inputs in parallel (2 MPP trackers/ 2 parallel input).

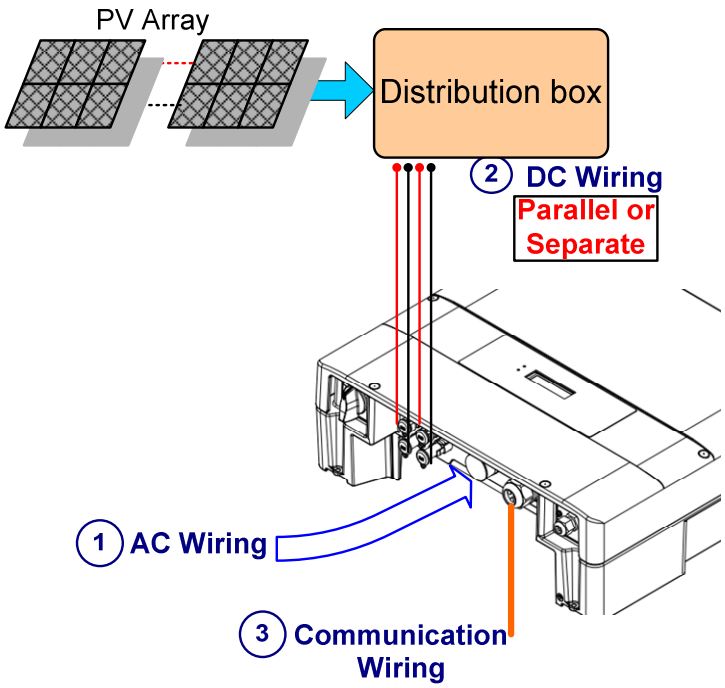



*Figure 5-1: Connection of a system for floating solar array*

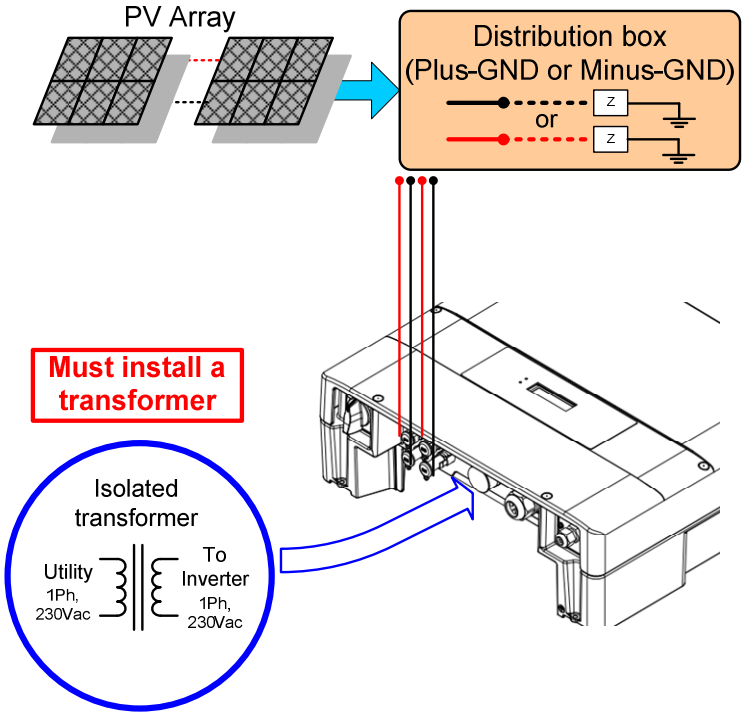



*Figure 5-2: Connection of a system for solar array grounding*

WARNING! SHOCK HAZARD

Note: Whenever a PV array is exposed to sunlight, a shock hazard may exist due to output wires or exposed terminals. To reduce the risk of shock during installation, cover the array with an opaque (dark) material and ensure that the Disconnect Device in the inverter is set to OFF before commencing any wiring.

## 5.2 AC Grid Connection: L + N + PE

WARNING!

Before commencing AC wiring, please ensure AC breaker is switched off.

### 5.2.1 Required protective devices and cable cross-sections

*Table 5-1: Recommended upstream protection*

| | Power rating | Upstream circuit breaker |
|---|---|---|
| RPI H3A | 3.75kVA | 20A |
| RPI H4A | 5 kVA | 25A |
| RPI H5A | 6.25 kVA | 30A |

Please use appropriate wire to connect poles (According to the *Table 5-2*).

*Table 5-2: AC wire requirement*

| Current Rating | Wire size | Torque |
|---|---|---|
| >20A (RPI H3A),<br>>25 A (RPI H4A),<br>>30 A (RPI H5A) | 3-4mm$^2$ / 12 AWG | 0.8~1Nm |

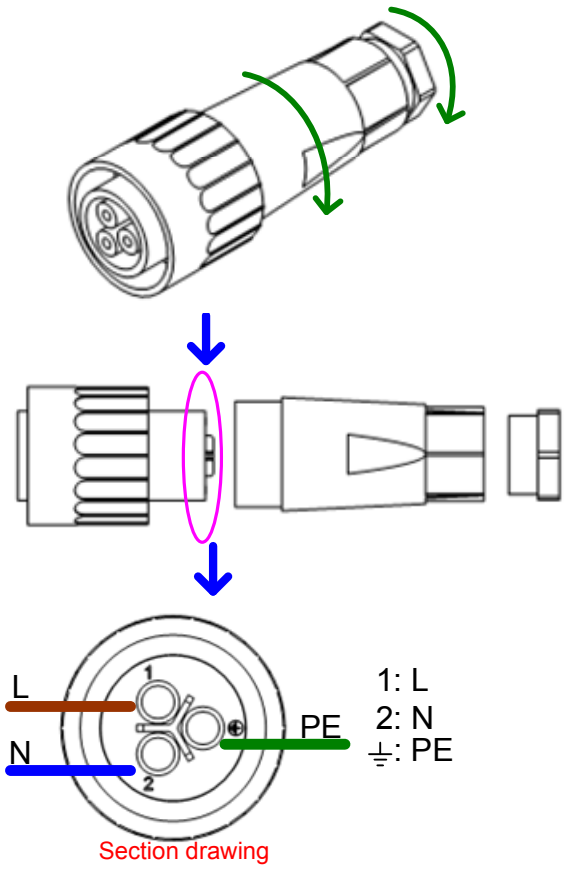



*Figure 5-3: AC plug illustration (C01620E0028001, AMPHENOL CORP)*

## 5.3 DC Connection (from PV Array)

WARNING!

- When undertaking DC wiring, please ensure the correct polarities are connected.
- When undertaking DC wiring please ensure that the DC isolator switch on the PV array is OFF.

CAUTION!

The maximum open circuit voltage of the PV Array must not exceed 600Vdc.
The maximum recommended input power to the inverter is:
3150W (RPI H3A)/ 4200W (RPI H4A)/ 5250W (RPI H5A).

Note: The device installed between the PV Array and inverter must meet the rating of voltage higher than this device's maximum input voltage.

The RPI range of PV inverters uses genuine Multi-Contact® MC4 connectors.

*Table 5-3: Order Numbers for MC4 connectors*

| CABLE COUPLER POLARITY | WIRE SIZE 2.5 $MM^2$ (AWG 14) | WIRE SIZE 4.0 $MM^2$ - 6.0 $MM^2$ (AWG 12-10) | FEMALE CABLE COUPLER | MALE CABLE COUPLER | MULTI-CONTACT ORDER NUMBER |
|---|---|---|---|---|---|
| Plus coupler | ● | | ● | | 32.0010P0001-UR<br>32.0012P0001-UR |
| Minus coupler | ● | | | ● | 32.0011P0001-UR<br>32.0013P0001-UR |
| Plus coupler | | ● | ● | | 32.0014P0001-UR<br>32.0016P0001-UR |
| Minus coupler | | ● | | ● | 32.0015P0001-UR<br>32.0017P0001-UR |

*Table 5-4: Minimum cable size*

| Current Rating | | Wire size |
|---|---|---|
| DC 10 A (RPI H3A) | DC 12 A(RPI H4A / H5A) | 2-3$mm^2$ / 14 AWG |

DC wiring polarities are divided into Plus and Minus, which are shown in *Figure 5-4*. The connection shall conform to the indication marked on inverter.

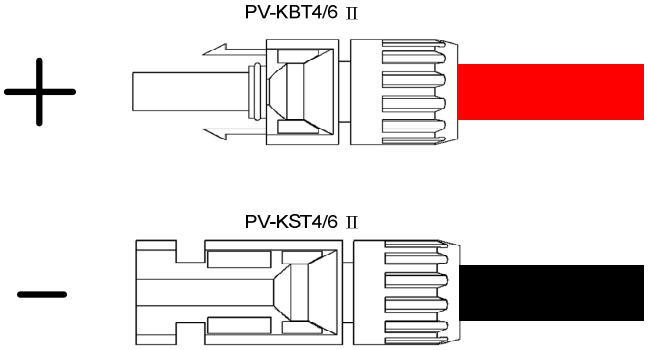



*Figure 5-4: DC Wiring illustration*

## 5.4 Communication Module

The Communication Module enables communication between the unit and a computer and provides 2 RS-485 ports. When using this module, the first step is to take off the cover located at the bottom right of inverter and pull out the RS485 socket as shown in *Figure 5-5*.

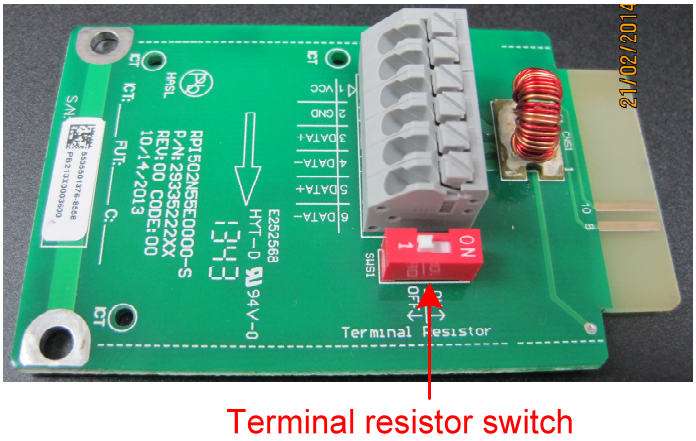



*Figure 5-5: Communication module*

### 5.4.1 RS-485 Connection

The pin definition of RS-485 shown in *Table 5-5* and protocol settings are listed in *Table 5-6*. Installer must switch the terminal resistor switch to **ON** when only a single inverter is installed. The wiring of multi-inverter is shown in *Figure 5-6*. The terminal resistor switch of the first and last inverters should be switched **ON**, and the others **OFF**.

*Table 5-5: Definition of RS485*

| PIN | FUNCTION |
|---|---|
| 1 | VCC |
| 2 | GND |
| 3 | DATA+ |
| 4 | DATA- |
| 5 | DATA+ |
| 6 | DATA- |

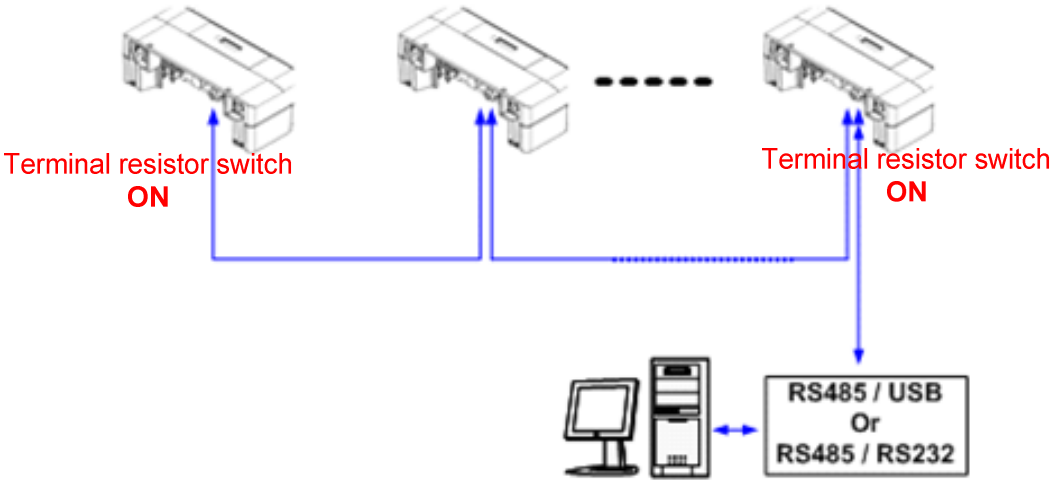



*Figure 5-6: Multi-inverter connection illustration*

*Table 5-6: RS-485 data format*

| RS-485 Data format | |
|---|---|
| Baud rate | 9600 / 19200 |
| Data bit | 8 |
| Stop bit | 1 |
| Parity | N/A |

# 6 Active/Reactive Power Control and LVRT (Optional)

There are 2 settings for active power and 4 settings for reactive power control that can be configured based on the requirement of the local network operator.

## 6.1 Active Power Control

### 6.1.1 Power Limit

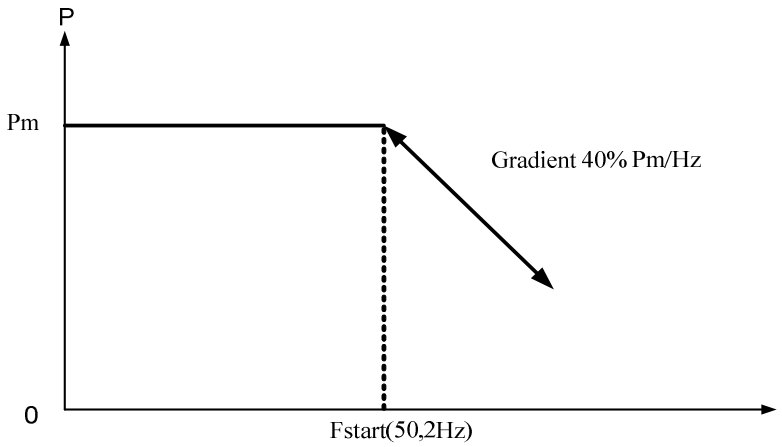
Users can reduce inverter output power by set percentage of actual or rated power.

### 6.1.2 Power vs. Frequency

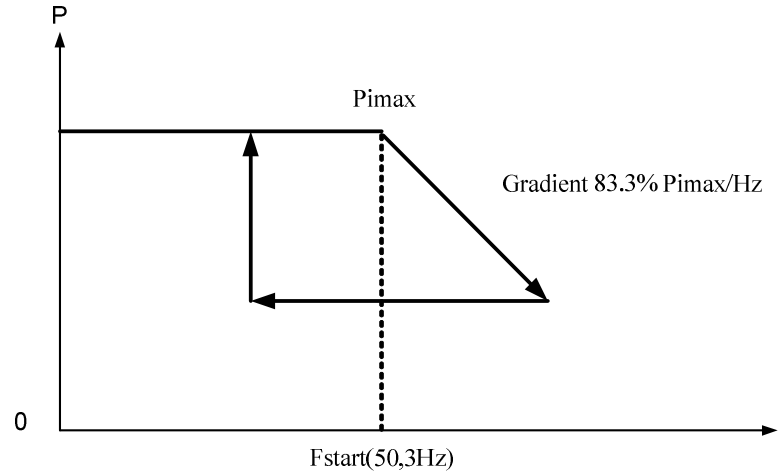
According to VDE-AR-N 4105 (5.7.3.3):
At frequencies between 50.2Hz and 51.5Hz, all adjustable power generation systems shall reduce (for frequency increase) or increase (for frequency decrease) the active power Pm generated instantaneously (at the time of exceeding the mains frequency 50.2Hz; freezing the value on the current level) with a gradient of 40% of Pm per Hertz).

According to CEI 0-21 (8.5.3.2):
Within a frequency range from 50.3Hz to 51.5Hz, all adjustable production plants equipped with static converters have to be able to reduce the currently generated active power in case of an increase of the frequency with a variable drop of 2% to 5% with a default value of 2.4% (with corresponds to a power gradient of 83.3%/Hz).

User can set all necessary settings to meet the requirements from network operator. Please refer to actual Power vs. Frequency shown in *Figure 6-1* for the settings procedure.




Power vs. frequency curve for VDE-AR-N 4105




Power vs. frequency curve for CEI-021

*Figure 6-1: Power vs. frequency characteristic*

## 6.2 Reactive Power Control

With active power output, it must be possible to operate the generating plant in any operating point with at least a reactive power output corresponding to a active factor at the network connection point of

- cos ϕ = 0.8 underexcited to 0.8 overexcited
- (VDE-AR-N 4105,CEI 0-21 cos ϕ = 0.9 underexcited to 0.9 overexcited)

Values deviating from the above must be agreed upon by contract. With active power output, either a fixed target value for reactive power provision or a target value variably adjustable by remote control (or other control technologies) will be specified by the network operator in the transfer station.

The setting value is either：

- fixed power factor cosφ (VDE-AR-N 4105 ,CEI 0-21)
- displacement factor/active power characteristic curve cosφ(p) (VDE-AR-N 4105 ,CEI 0-21)
- fixed reactive power in Var.(CEI 0-21)
- reactive power/voltage characteristic Q(U). (CEI 0-21)

### 6.2.1 Fixed Power Factor cosφ (VDE-AR-N 4105,CEI 0-21)

Users can set power factor from Cap 0.8 to Ind 0.8 (inverter would stop reactive power control if output power is below 20% rated power). \

### 6.2.2 cosφ(P) (VDE-AR-N 4105,CEI 0-21)

Once user enables this method, inverter will deliver reactive power according to output active power at that moment. *Figure 6-2* is an example.

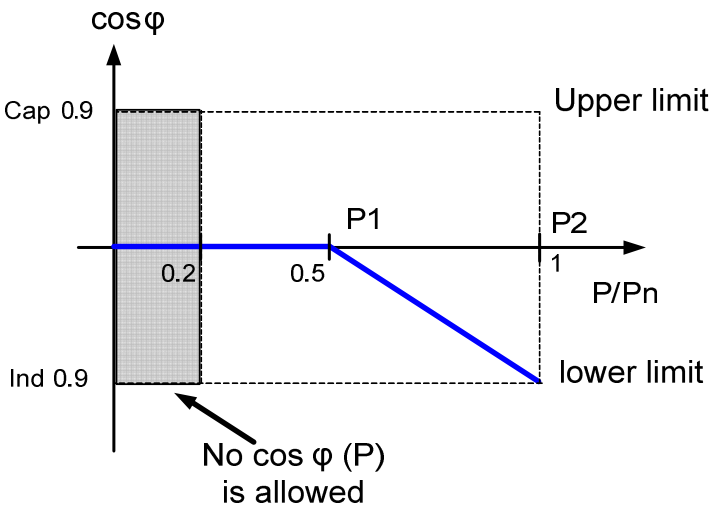


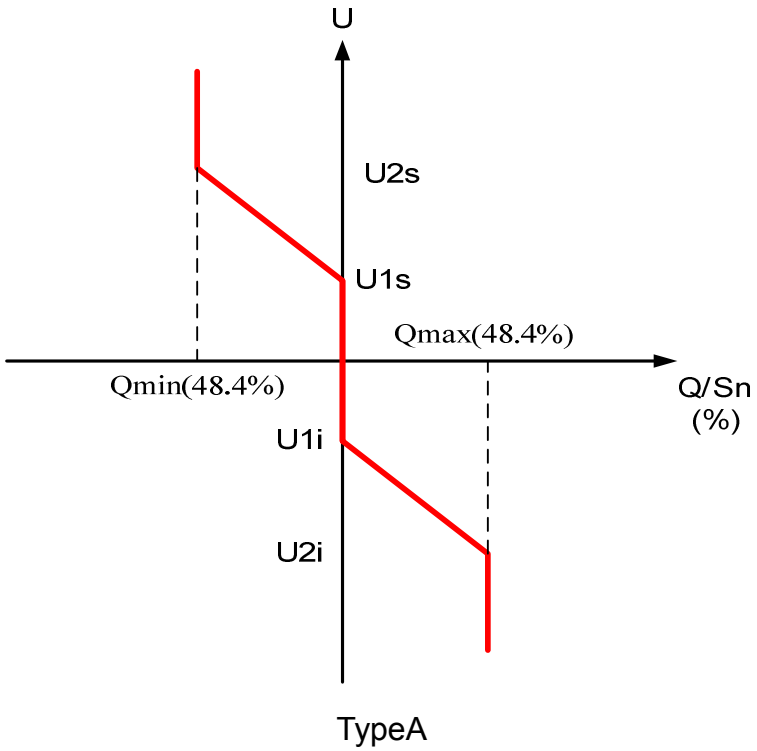

*Figure 6-2: cosφ(P) characteristic*

### 6.2.3 Fixed Reactive Power InVAR(CEI 0-21)

Once user enables this method, inverter will deliver reactive power (ie. Q) consistent with that of the fixed reactive power setting. The setting range is from Cap 48.4% to Ind 48.4%.

### 6.2.4 Reactive Power/ Voltage Characteristic Q(U)(CEI 0-21)

Once user enables this method, user can set Q vs Grid voltage operation curve as in *figure 6-3* below.



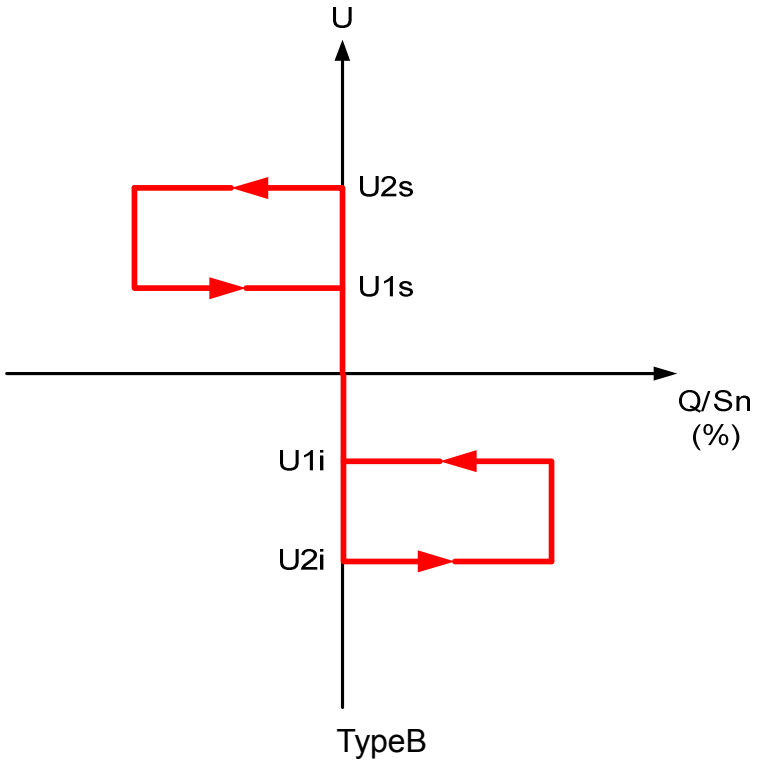




*Figure 6-3: Q(U) characteristic*

## 6.3 Low Voltage Ride Through (LVRT)

According to CEI 0-21, 8.5.1

*To avoid undue separation from the network if voltage dips occur, a generation system with over 6 kW total power must be able to comply with certain functional requirements, which are known as LVRT (Low Voltage Ride Through) in international literature.*

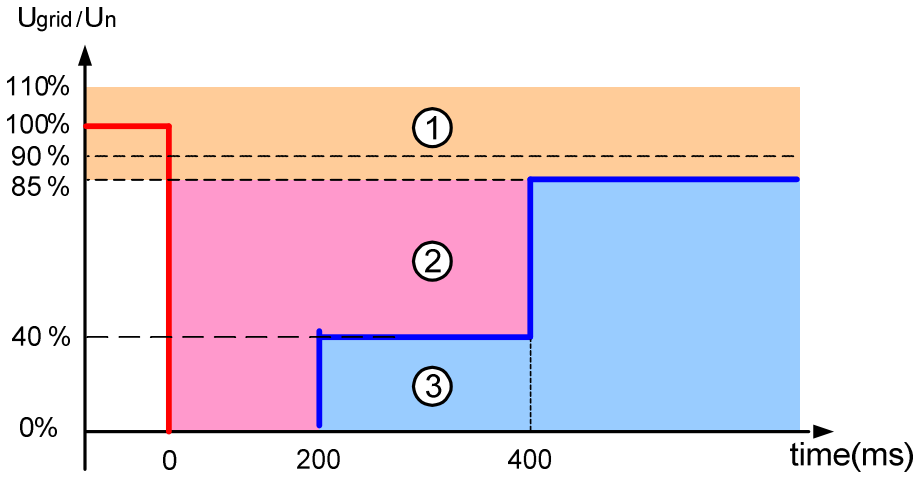



*Figure 6-4: LVRT characteristic*

# 7 Turn PV inverteron/off

WARNING：BURN HAZARD

The internal temperature may exceed over 70℃ while operating. To avoid injury,do not touch the surface of the inverter whilst the unit is in operation.

After installation, please ensure the AC, the DC and communication connection are correct. When enough power is generated from the PV array, the device will operate automatically and will initial ‘self-test’. This self-test takes approximately 2 minutes and will occur at first start-up of the day.

The display on the inverter includes 16×2 LCD display and LED indicator lights to indicate inverter status. There are green and red colour LED indicator lights to represent different inverter statuses.

## 7.1 Start-up Procedures

### 7.1.1 PV Array DC Voltage Checking

Firstly, uncover the PV arrays and expose them to full sunlight. Please note, the sunlight must be intense enough to produce the required output voltage for the inverter to start up.
Measure the PV array open circuit DC voltage across the DC positive (+) and negative (-) terminals.

### 7.1.2 AC Utility Voltage Checking

Using an AC voltmeter, measure the AC open circuit utility voltage between L1 (L) and L2 (N) Ensure the voltage is at approximately the nominal value. The inverter operates with a line-to-line voltage range around the nominal value. See “11. Technical data” output section for the utility voltage operating range for your inverter model.

### 7.1.3 Starting up the Inverter

Switch the DC and AC disconnection switches (breakers) to “ON”.
Check the inverter LCD display. The start-up screen should appear in several

seconds (for the first time start up, select proper country and language, see “7.3.2 Country Selection & 7.3.3 Language Selection”).

## 7.2 Inverter Setting

### 7.2.1 Country Setting

Upon first start-up of the device, Country selection is required.

1. In the country setting page, press “SEL” button (NEXT) to select your country, press “ENT” button to confirm this page.
2. Press “Enter” button to confirm your country setting.

NOTE:

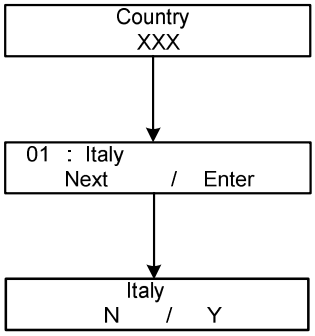



*Figure 7-1: Country Setting*

### 7.2.2 Connecting the Communication Wiring

Multiple inverters can be monitored via the inverter’s RS-485 connection (*Figure 5-6*), but each inverter’s ID must be assigned a unique value.

NOTE:

Make sure the inverter ID is different from each other in the same RS485 chain.

### 7.2.3 Inverter ID Setting

1. Turn on DC power and wait for the LCD display, then press “Select” button until “Inverter ID: XX" is shown in the LCD.
2. Press and hold both buttons (“Enter” first, then “Select”) entering setting ID screen, then release both buttons and set ID by pressing “Select” button, then press “Enter” button if the ID is correct (ID = 1 ~ 254).
3. Inverter ID is changed and saved.

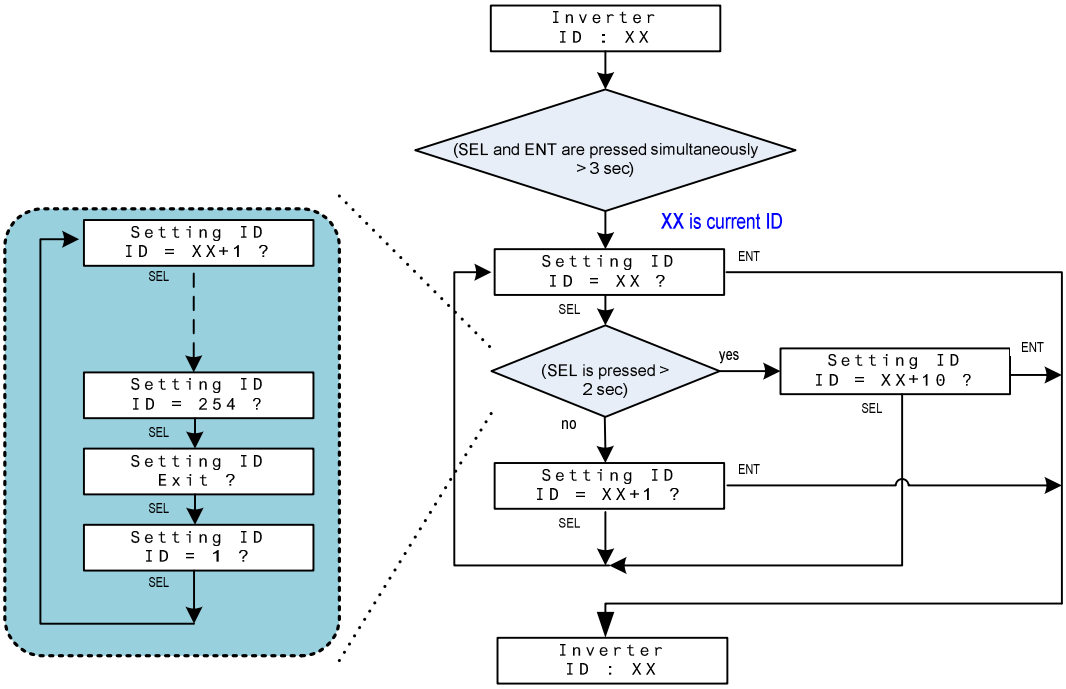



*Figure 7-2: Inverter ID Setting*

## 7.3 LCD flowchart

Pressing any button will enter main menu (*Figure 7-3*), “Output Energy (today)” is the first option on the main menu with several other items below as seen in section 7.3.1 ~ 7.3.7.

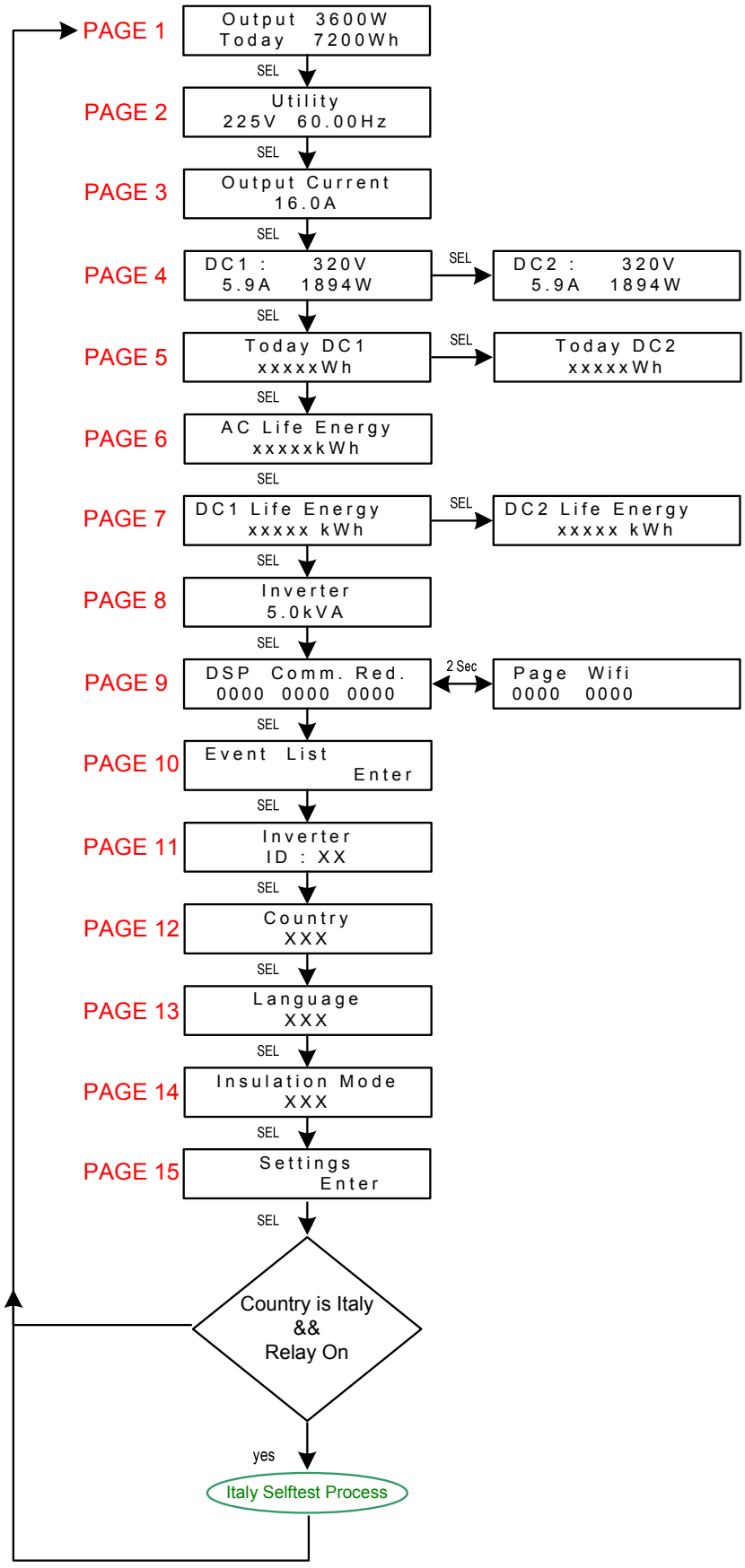



*Figure 7-3: LCD flowchart*

| | |
|---|---|
| Page1 | Today output energy |
| Page2 | Grid voltage and frequency |
| Page3 | Output current |
| Page4 | Input voltage, current and power |
| Page5 | Today input energy |
| Page6 | Total output energy |
| Page7 | Total input energy |
| Page8 | Start page |
| Page9 | Firmware version |
| Page10 | Event list |
| Page11 | Inverter ID |
| Page12 | Country |
| Page13 | Language |
| Page14 | Insulation / Grounding option |
| Page15 | Settings |

### 7.3.1 Event List

When entering this menu, the display will show all the events (error or fault) and it can show up to 16 records at most with the latest one on the top.

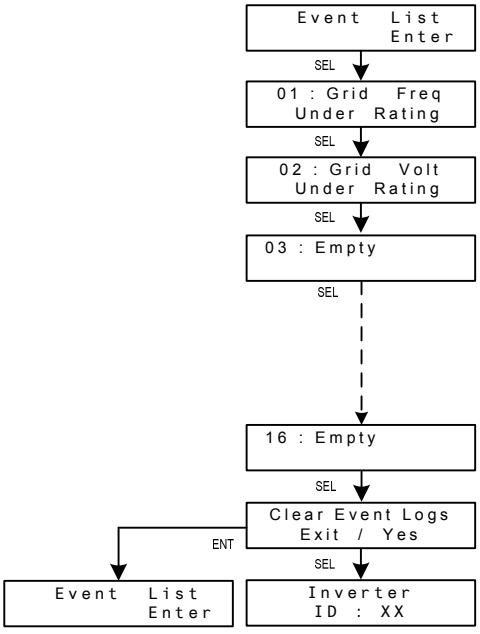



*Figure 7-4: Event log flowchart*

### 7.3.2 Country Selection

Users can select different countries in this menu.

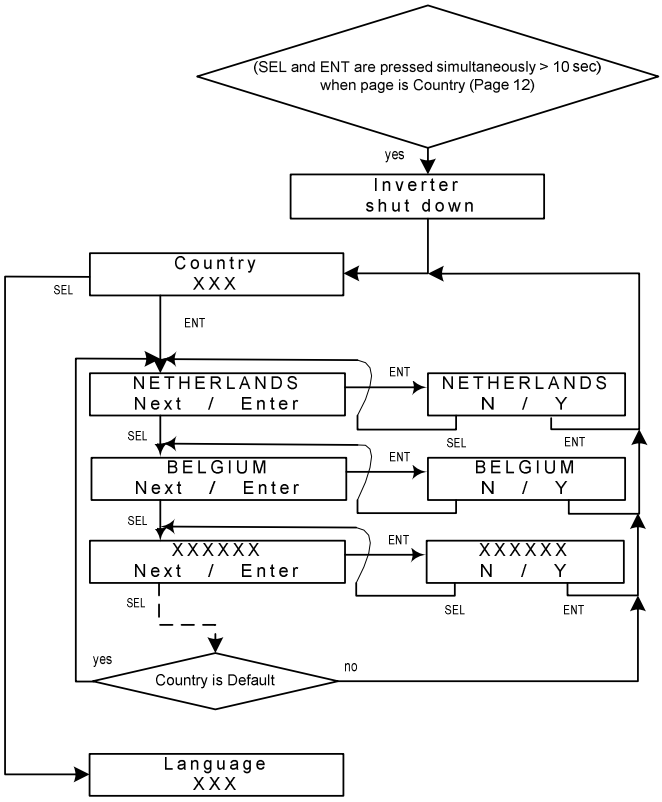



*Figure 7-5: Country selection*

*Table 7-1: Country list*

| RPI H3A/ H4A/ H5A | |
|---|---|
| AU/NZ | Italy MV(for RPI H5A only) |
| AU/NZ PL4k6 | Portugal |
| AU/NZ PL4k99 | Spain (RD661) |
| Belgium | Spain RD1699 |
| England (UK G59-2 230) | Taiwan |
| France LV | Thailand MEA |
| French Islands 50Hz | Thailand PEA |
| French Islands 60Hz | Turkey |
| Germany | UK G59-2 240 |
| India | UK G83-2 |
| Italy LV/SPI | |

### 7.3.3 Language Selection

When entering this menu, user can set one of five different languages.

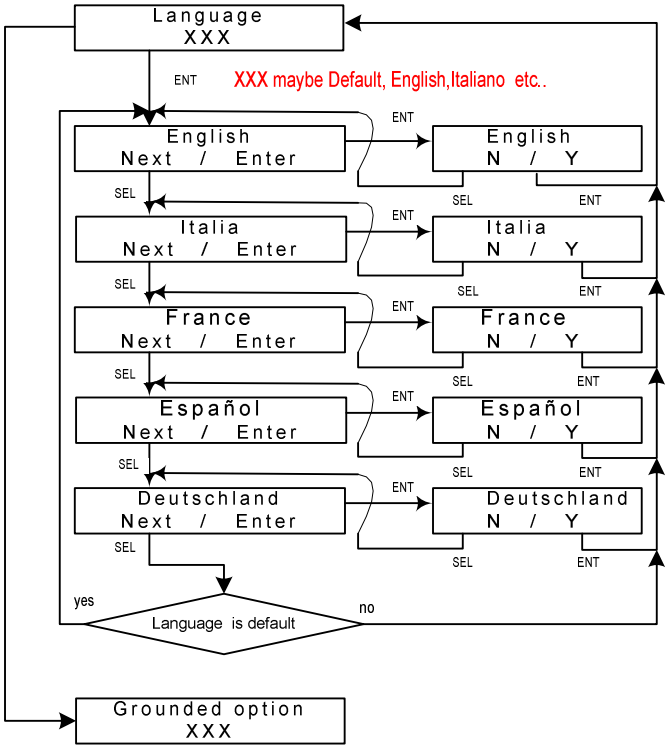



*Figure 7-6: Language selection*

*Table 7-2: Language list*

| RPI H3A/ H4A/ H5A |
|---|
| English |
| Italiano |
| Français |
| Español |
| Deutsch |

## 7.3.4 Insulation Mode

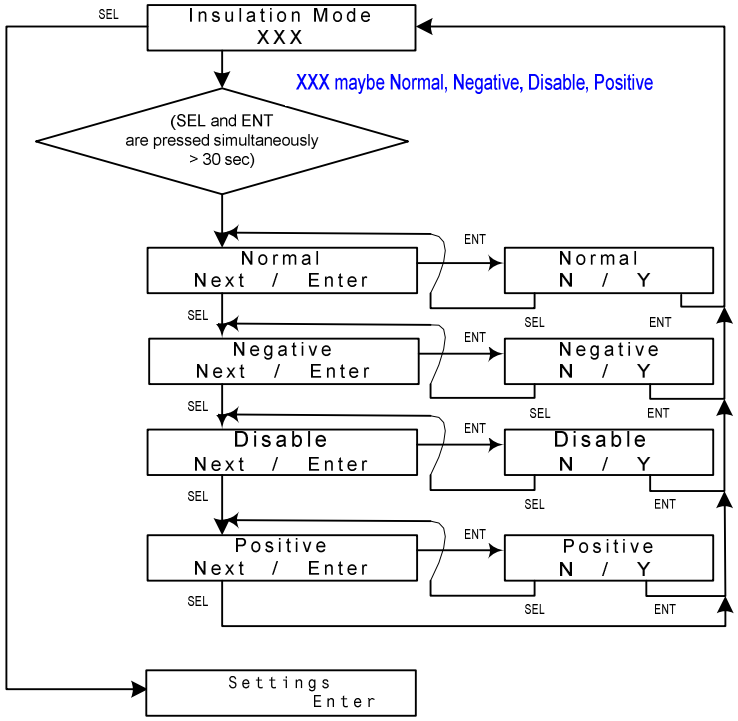



*Figure 7-7: Insulation mode*

## 7.3.5 Time Setting

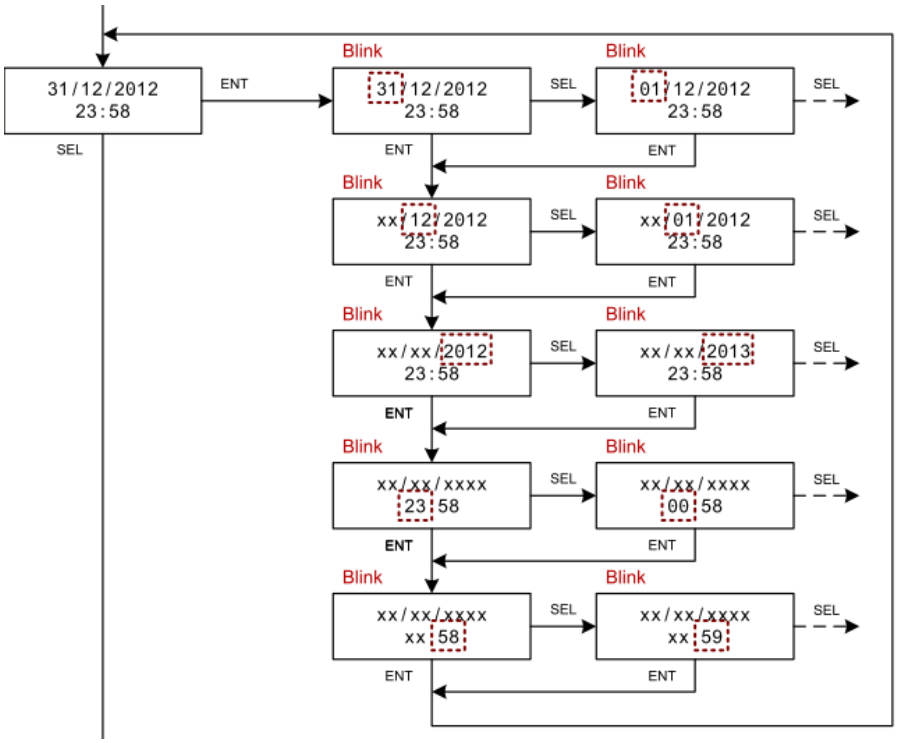



*Figure 7-8: Time setting*

### 7.3.6 Settings Page

Settings include WiFi, Ethernet IP address and WiFi IP address.

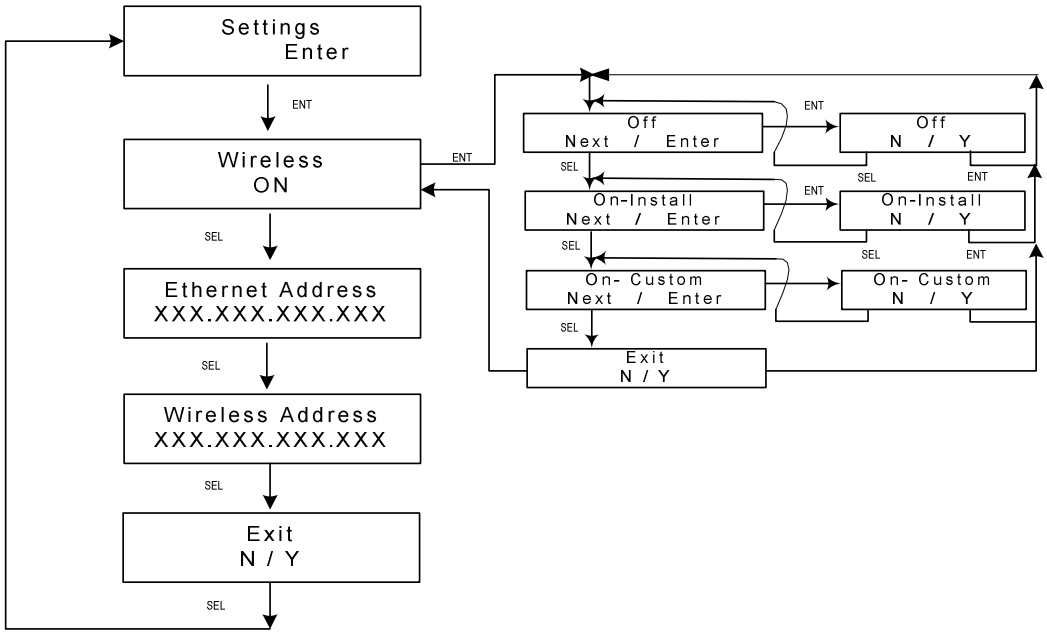



*Figure 7-9: Settings page*

### 7.3.7 Italy Self-test&Comando locale

Please note, Italy self-test setting will only exist when Italy is selected in country setting. Italy Self-test includes UacHigh (UH), Uac Low(UL), Fac High(FH) and Fac Low(FL). The user can choose the selection of Uac High, Uac Low, Fac High, or Fac Low separately. The final testing result will be shown on the operating menu and saved where the user can view the results. If the Italy Self-test fail's, the inverter will not operate. Please contact Delta or your supplier.

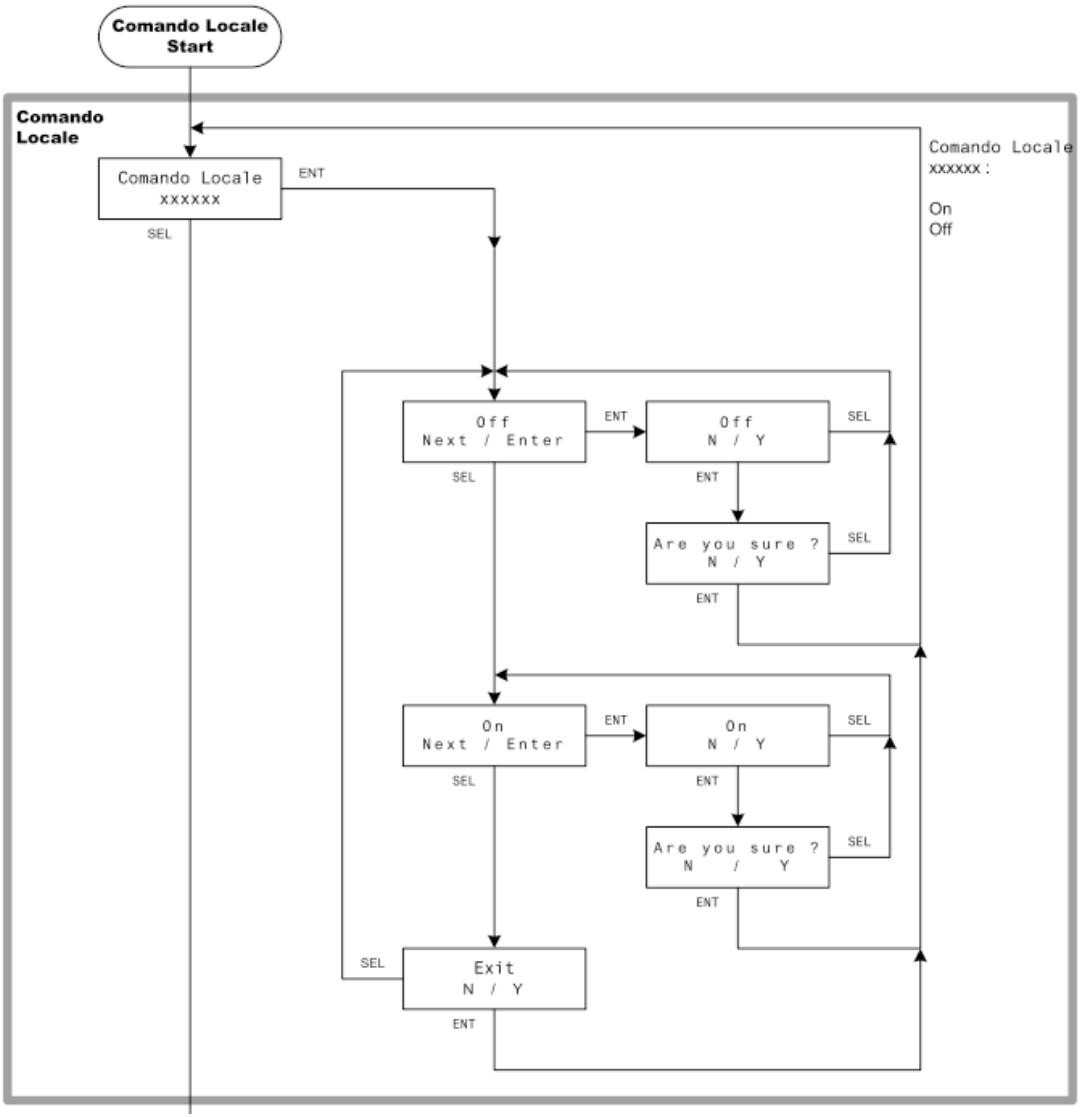



*Figure 7-10: Italy Comando locale*

# Italy self-test

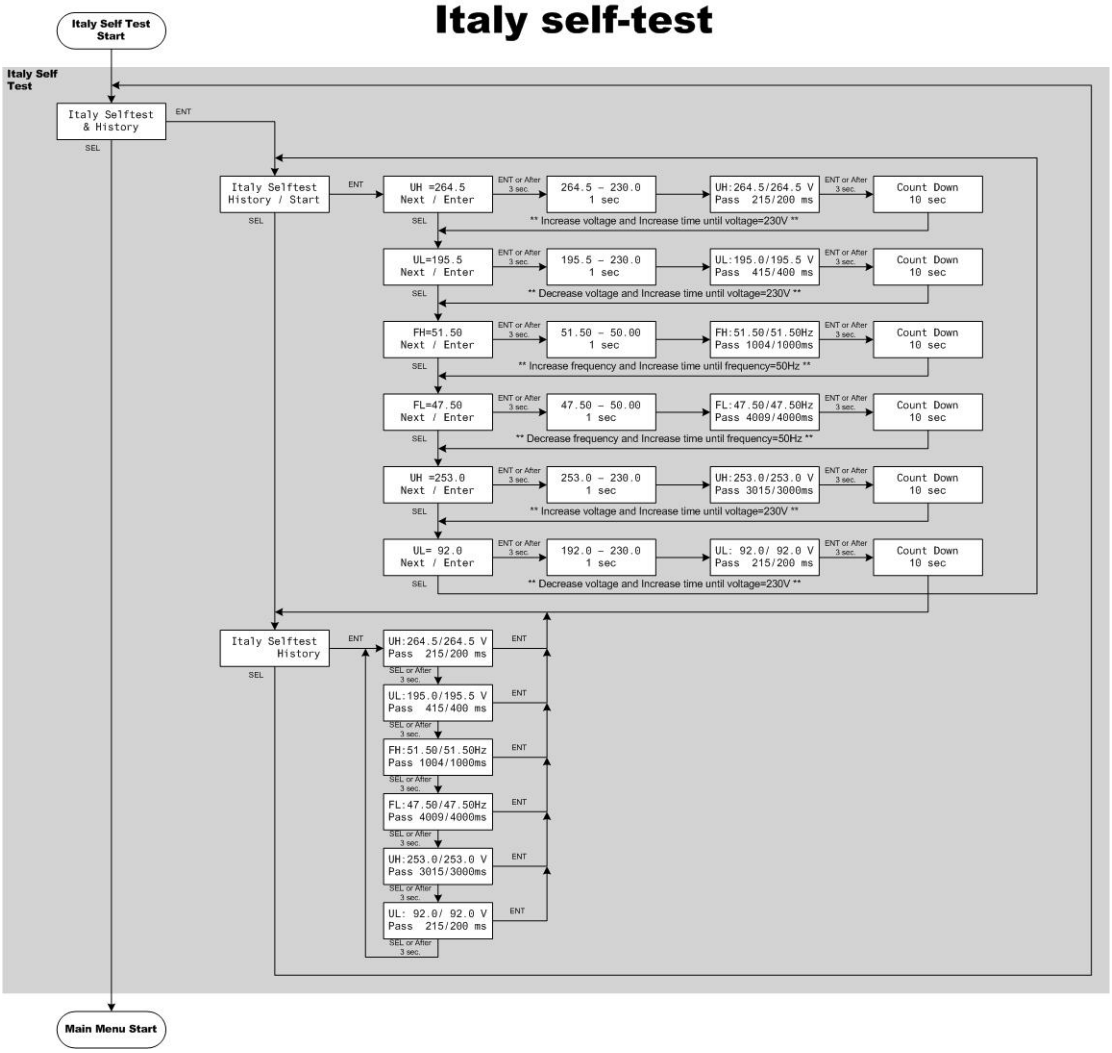

Italy Self Test Start
Italy Self Test
Italy Selftest & History
ENT
SEL
Italy Selftest History / Start
UH =264.5 Next / Enter
264.5 – 230.0 1 sec
UH:264.5/264.5 V Pass 215/200 ms
Count Down 10 sec
** Increase voltage and Increase time until voltage=230V **
UL=195.5 Next / Enter
195.5 – 230.0 1 sec
UL:195.0/195.5 V Pass 415/400 ms
** Decrease voltage and Increase time until voltage=230V **
FH=51.50 Next / Enter
51.50 – 50.00 1 sec
FH:51.50/51.50Hz Pass 1004/1000ms
** Increase frequency and Increase time until frequency=50Hz **
FL=47.50 Next / Enter
47.50 – 50.00 1 sec
FL:47.50/47.50Hz Pass 4009/4000ms
** Decrease frequency and Increase time until frequency=50Hz **
UH =253.0 Next / Enter
253.0 – 230.0 1 sec
UH:253.0/253.0 V Pass 3015/3000ms
** Increase voltage and Increase time until voltage=230V **
UL= 92.0 Next / Enter
192.0 – 230.0 1 sec
UL: 92.0/ 92.0 V Pass 215/200 ms
** Decrease voltage and Increase time until voltage=230V **
Italy Selftest History
ENT or After 3 sec.
SEL or After 3 sec.
Main Menu Start

*Figure 7-11: Italy self-test flowchart*

# 8 Maintenance

In order to ensure normal operation of the inverter, please check the unit regularly. Check that all terminals, screws and cables are connected and appeared as they did upon installation. If there are any impaired or loose parts, please contact your solar installer.
Ensure that there are no foreign objects in the path of the heat outlet and keep the unit and its surroundings clean and tidy.

**WARNING!**

Before any maintenance, please switch AC and DC power off to avoid risk of electronic shock.

# 9 MeasurementError Message and Trouble Shooting

## 9.1 Measurement

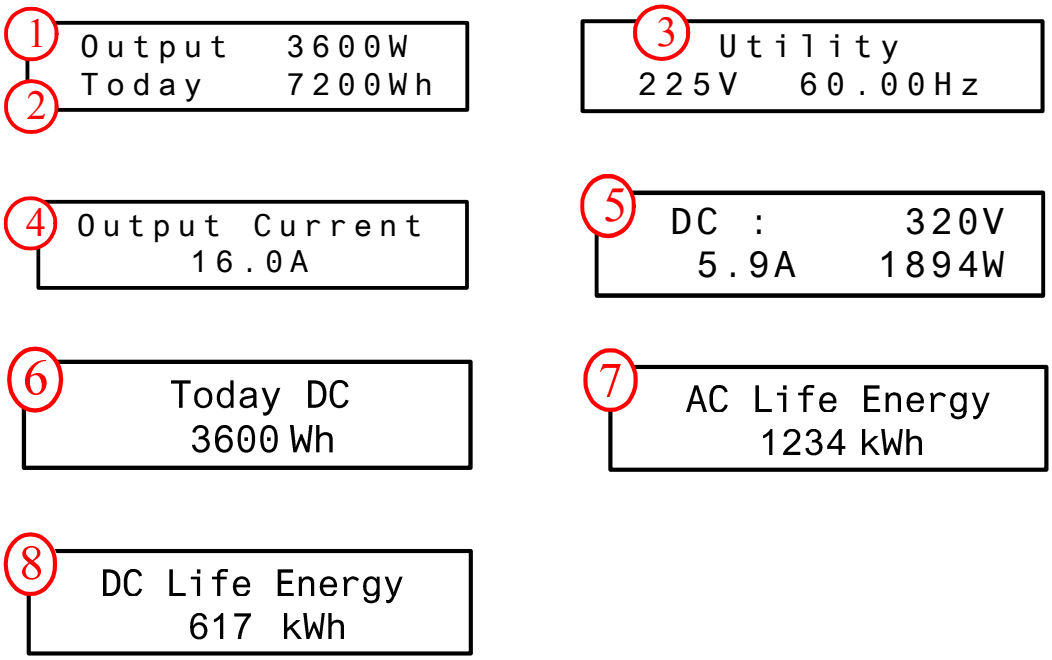



*Table 9-1: Measurement and message*

| No. | Measurement | Meaning | Unit |
|---|---|---|---|
| 1 | Output | Actual power inverter is exporting | W |
| 2 | Today | Energy generated today | Wh |
| 3 | Utility | Grid Voltage and Frequency | Vac / Hz |
| 4 | Output Current | Actual Output AC current | A |
| 5 | DC | DC input Voltage, Current, Watt | Vdc, A, W |
| 6 | Today DC | Today PV array energy supply, cumulative | Wh |
| 7 | AC Life Energy | Total Energy generated, cumulative | kWh |
| 8 | DC Life Energy | Total PV array energy supply, cumulative | kWh |

## 9.2 Error Message & Trouble Shooting

*Table 9-2: Error message*

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| E01: Grid Freq. Over Rating | 1. Actual utility frequency is higher than the OFR setting<br>2. Incorrect country setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country setting<br>3. Check the detection circuit inside the inverter |
| E02: Grid Freq. Under Rating | 1. Actual utility frequency is lower than the UFR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E07:Grid Quality | Non-linear load in Grid and close to inverter | Grid connection of inverter need to be away from non-linear load if necessary |
| E09: No Grid | 1. AC breaker is OFF<br>2. AC plug Disconnected<br>3. Internal fuses are broken | 1. Switch on AC breaker<br>2. Check the connection in AC plug and make sure it connects to inverter<br>3. Replace fuses and check all switching devices in boost & inverter stages |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| E10: Grid Volt Under Rating | 1. Actual utility voltage is under the UVR setting<br>2. Utility voltage is under the Slow UVR setting during operation<br>3. Incorrect country or Grid setting<br>4. Detection circuit malfunction | 1. Measure the utility AC voltage to the inverter terminal.<br>2. Check the utility AC voltage connection to the inverter terminal.<br>3. Check country & Grid setting<br>4. Check the detection circuit inside the inverter |
| E13: Slow Over Voltage Range | 1. Actual utility voltage is over the OVR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility voltage on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E26:Slow Over Frequency Range | 1. Actual utility frequency is over the OFR setting<br>2. Incorrect country or grid setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country setting<br>3. Check the detection circuit inside the inverter |
| E27:Slow Under Frequency Range | 1. Actual utility frequency is under the UFR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| E28: Slow Under Voltage Range | 1. Actual utility voltage is under the UVR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility voltage on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E30: DC Volt Over Rating | 1. Actual Solar1 voltage is higher than 550Vdc<br>2. Detection circuit malfunction | 1. Modify the solar array string layout and reduce the Voc below 550Vdc<br>2. Check the detection circuit inside the inverter |
| E34: Ground Fault | 1. PV array insulation fault<br>2. Large PV array capacitance between Plus to Ground or Minus to Ground or both.<br>3. Detection circuit malfunction | 1. Check the insulation of Solar inputs<br>2. Check the capacitance, dry PV panel if necessary<br>3. Check the detection circuit inside the inverter |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| A01: DC Offset Over Rating | 1. Utility waveform is abnormal<br>2. Detection circuit malfunction | 1. Check the utility waveform. Grid connection of inverter need to be away from non-linear load if necessary<br>2. Check the detection circuit inside the inverter |
| A05: NTC Over Temp | 1. The ambient temp. is above 60°C<br>2. Detection circuit malfunction | 1. Check the installation ambient temp. and environment<br>2. Check the detection circuit inside the inverter |
| A06: Inside NTC Circuit Fail | 1. Ambient temp. >100°C or <-24°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter |
| A08: Heat Sink NTC1 Fail | 1. Boost heat sink temp. >100°C or <-24°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter. |
| A09: Heat Sink NTC2 Fail | 1. Inverter heat sink temp. >100°C or <-24°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter |
| A15:DSP ADC $V_{grid}$ / $I_{out}$ Fail | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| A16:DSP ADC $V_{in}$ / $V_{bus}$ Fail | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| A17:DSP ADC $I_{in}$ / $I_{boost}$ Fail | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| A18:RED. ADC $V_{grid}$ Fail | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| A19:DSP ADC $I_{out_dc}$Fail | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| A20: Efficiency Inconsistent | 1. The calibration is incorrect<br>2. Current feedback circuit is defective | 1. Check the accuracy of current and power<br>2. Check the current feedback circuit inside the inverter |
| A22: Internal CommFault_R | 1. Red. CPU is idling<br>2. The communication connection is disconnected | 1. Check reset and crystal in Red. CPU<br>2. Check the connection between Red. CPU and DSP |
| A23: Internal CommFault_D | 1. DSP is idling<br>2. The communication connection is disconnected<br>3. The communication circuit malfunction | 1. Check reset and crystal in DSP<br>2. Check the connection between DSP and COMM<br>3. Check the communication circuit |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| A24: Residual Curr Over Rating | 1. PV array insulation fault<br>2. Large PV array capacitance between Plus to Ground or Minus to Ground<br>3. Either side of boost driver or boost choke malfunction<br>4. Detection circuit malfunction | 1. Check the insulation of Solar inputs<br>2. Check the capacitance (+ <-> GND & - <-> GND), must < 2.5uF. Install an external transformer if necessary<br>3. Check boost driver & boost choke<br>4. Check the detection circuit inside the inverter |
| A27: RCMU Circuit Fail | 1. RCMU is disconnected<br>2. Detection circuit malfunction | 1. Check the RCMU connection inside the inverter<br>2. Check the detection circuit inside the inverter |
| A28: Relay Short | 1. One or more relays are sticking<br>2. The driver circuit for the relay malfunction | 1. Replace the defective relay(s)<br>2. Check the driver circuit inside the inverter |
| A29: Relay Open | 1. One or more relays are abnormal<br>2. The driver circuit for the relay malfunction<br>3. The detection accuracy is not correct for $V_{grid}$ and $V_{out}$ | 1. Replace the defective relay(s)<br>2. Check the driver circuit inside the inverter<br>3. Check the $V_{grid}$ and $V_{out}$ voltage detection accuracy |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| A35: Bus Volt Over Rating | 1. Driver for boost is defective<br>2. $V_{oc}$ of PV array is over550Vdc<br>3. Surge occurs during operation<br>4. Detection circuit malfunction | 1. Check the driver circuit for boost inside the inverter<br>2. Modify the solar array setting, and make the $V_{oc}$ less than550Vdc<br>3. N/A<br>4. Check the detection circuit inside the inverter |
| A36:Output Curr Transient Over | 1. Surge occurs during operation<br>2. Driver for inverter stage is defective<br>3. Switching device is defective<br>4. Detection circuit malfunction | 1. N/A<br>2. Check the driver circuit in inverter stage<br>3. Check all switching devices in inverter stage<br>4. Check the detect circuit inside the inverter |
| A37: AC Curr Over Rating | Detection circuit malfunction | Check the detect circuit inside the inverter |
| A42: CT Current Sensor Fail | 1.Inverter choke Fail<br>2.Output Filter Fail<br>3. Detection circuit malfunction | 1. Check Inverter choke inductance.<br>2. Check output filter capacitance.<br>3. Check the detection circuit inside the inverter |
| A50:Zero Cross Circuit Fail | The detection circuit for synchronous signal malfunction | Check the detection circuit for synchronous signal inside the inverter |

| ERROR | | |
|---|---|---|
| Message | Possible cause | Action |
| A56:Hardware Incompatibility | HW power rating incorrect | Check comm. HW power rating info. |
| A60: DC1Curr Over Rating | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |
| A61: DC2Curr Over Rating | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |
| A70: DC1Curr Transient Over | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |
| A71: DC2Curr Transient Over | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |

# 10 De-Commissioning

De-Commissioning Procedure:
If necessary to put the device out of operation for maintenance and/or storage, please follow the instructions below.

**WARNING!**
To avoid injuries, please follow the procedures

- Switch off AC circuit breaker to disconnect from electricity grid.
- Switch off the PV Array switch to disconnect from PV Array.
- Use proper voltage meter to confirm that the AC and DC power are disconnected from the unit.
- Remove the AC wiring immediately to completely disconnect from electricity grid.
- Remove the DC wiring to disconnect from PV Array.
- Remove the communication module RS-485 connection from the computer connection.
- After completing the above steps, the inverter can be removed.

# 11 Technical Data

## 11.1 Specifications

*Table 11-1: Specifications*

| Model | RPI H3A | RPI H4A | RPI H5A |
|---|---|---|---|
| **GENERAL** | | | |
| Enclosure | Powder-coated aluminium | | |
| Operating temperature | -25~60°C, full power up to 40°C | | |
| Relative humidity | 0% – 95% non-condensing. | | |
| Galvanic isolation | No (TL Topology) | | |
| Safety class | Class I metal enclosure with protective earth | | |
| Overvoltage category | III | | |
| **DC INPUT (Solar side)** | | | |
| Max. recommended input power | 3150W | 4200W | 5250W |
| Max. input voltage | 600Vdc | | |
| Operating voltage range | 100~550 Vdc | | |
| MPP range (rated power) | 160~500Vdc | 180~500Vdc | 220~500Vdc |
| Nominal voltage | 350Vdc | | |
| MPP Tracker | 2 | | |
| Max. input current (each MPPT) | 10A | 12A | 12A |
| Max. short circuit current per MPPT | 13.9A | 16.7A | 16.7A |
| Max. inverter backfeed current to the array | 0A | | |
| Startup voltage | 100Vdc | | |
| Input connection | 2 pairs Multi-Contact® MC4 connectors | | |
| **AC OUTPUT (Grid side)** | | | |
| Nominal output power | 3000VA | 4000VA | 5000VA |
| Maximum power | 3000VA | 4000VA | 5000VA |
| Voltage | 230Vac -20%~+22% | | |
| Nominal output current | 13A | 17.3A | 21.7A |
| Max. output current | 13.9A | 18.2A | 23.2A |
| Maximum output fault current | 16A | 20A | 32A |

| Model | | RPI H3A | RPI H4A | RPI H5A |
|---|---|---|---|---|
| Maximum output over current protection | | 16A | 20A | 32A |
| **AC OUTPUT (Grid side)** | | | | |
| Current (inrush) (A, peak and duration) | | 30A peak, 1ms. | | |
| Frequency | | 50/60Hz | | |
| Total harmonic distortion | | <3% @ Rated power(#1) | | |
| Power factor | | >0.99@Rated power(#1) | | |
| Peak efficiency | | 97.50% | 97.50% | 97.50% |
| EU efficiency | | 96.80% | 97.00% | 96.80% |
| Output connection | | IP 67 single-phase | | |
| Fuse | | Internal fuse, 20A/ 250V*2 | Internal fuse, 20A/ 250V*2 | Internal fuse, 20A/ 250V*2 |
| **MECHANICAL** | | | | |
| Housing | | Die cast | | |
| Cooling | | convection cooling | | |
| IP rating | | IP65 | | |
| External communication | | 2 x RS-485 connection | | |
| Weight | | 21 kg | | |
| Dimensions | | 414.3 × 475.3 × 155 mm | | |
| **REGULATIONS & DIRECTIVES** | | | | |
| Safety | | IEC 62109-1 / -2<br>AS 3100<br>CE compliance | | |
| Grid interface | | VDE AR-N 4105<br>AS 4777 | | |
| Emission | | IEC 61000-6-4, IEC 61000-6-3 | | |
| Harmonics | | EN 61000-3-12 | | |
| Variations and flicker | | EN 61000-3-11 | | |
| Immunity | | EN 61000-6-2 | | |
| Immunity | ESD | IEC 61000-4-2 | | |
| | RS | IEC 61000-4-3 | | |
| | EFT | IEC 61000-4-4 | | |
| | Surge | IEC 61000-4-5 | | |
| | CS | IEC 61000-4-6 | | |
| | PFMF | IEC 61000-4-8 | | |

#1: reactive power control disabled

# Appendix A

## Multi-function Relay

The Inverter supports one multi-function relay, the multi-function relay is available to external devices. External devices can be: flashing lights, Buzzer Etc. the multi-function relay allows following configuration:

- Fault indicator or Grid status indicator
- Power production
- Control of external loads
- Fan control

## A.1 Multi-function relay output connection

The dry contact connection provides a remote indication of inverter status. When the inverter is operating normally, the dry contact is closed. The user can use the Monitor MODBUS SW tool, the multi-function relay will be configured as mentioned in the event setting. Please refer to *Figure A-1*

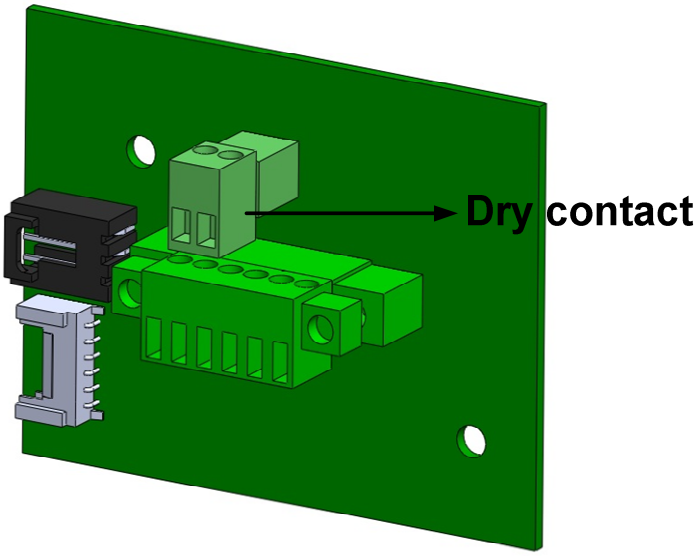



*Figure A-1: Multi-function Relay location*

**Danger! Hazard of Electric shock.**

Touching of electronic components can damage the components through electrostatic discharge.

# Appendix B

## Digital input

To implement power management, the digital input interface receives the specifications of the network operator via a ripple control receiver.

- Germany : The active power limitation in the stages 0%, 30%, 60% and 100%
- Italy : Power output of Max 6KW for PV plant installation.
  Remote shutdown
  Narrow Frequency limits between 49.5 Hz to 50.5Hz.
- Customer : User defined.

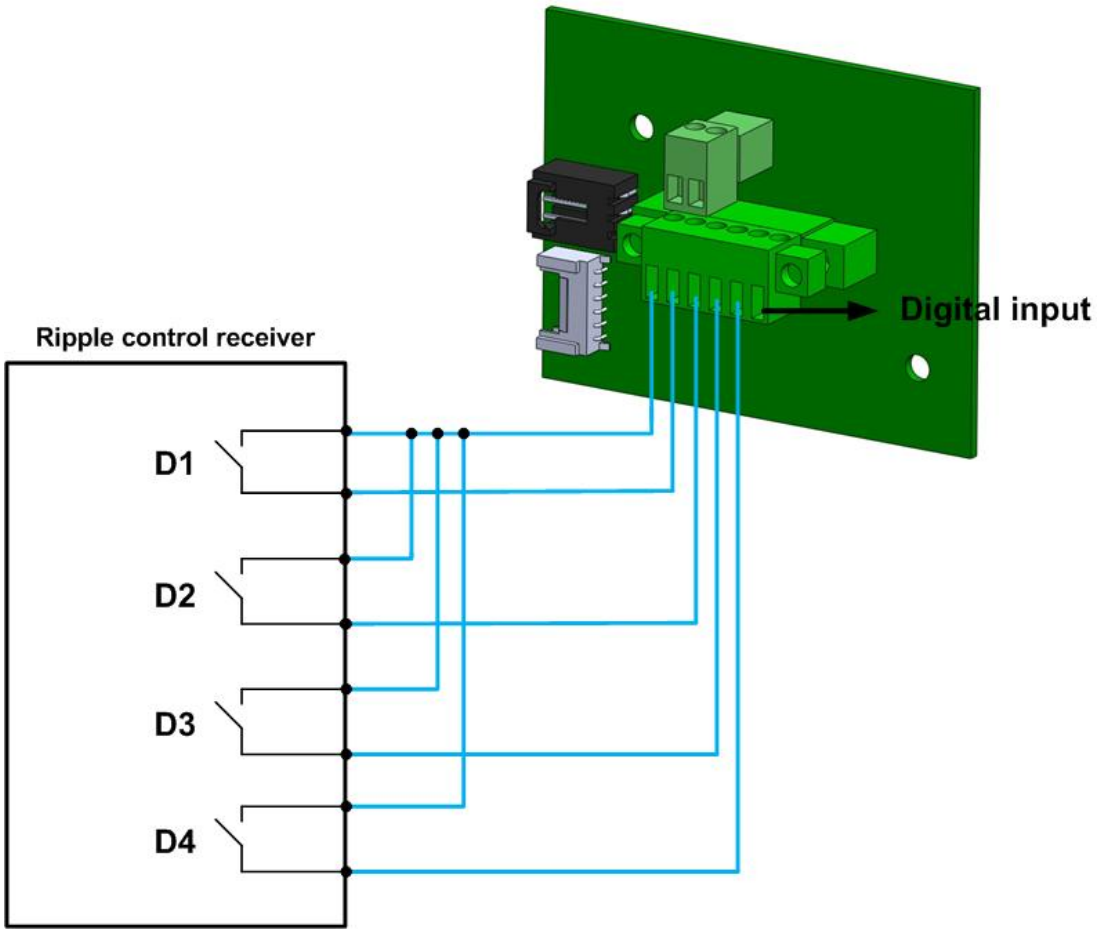



*Figure B-1: Pin assignment at ripple control receiver*

The inverter gives a voltage to the Output 1, 2 and measure Digital Input 1 to 4. The inverter can detect the status of the relay of the ripple control receiver. The information which relay shall be controlled parameter by the network operator.

| Pin | Function |
|---|---|
| 1 | Digital input 1 |
| 2 | Digital input 2 |
| 3 | Digital input 3 |
| 4 | Digital input 4 |
| 5 | Output 1 |
| 6 | Output 2 |

Country =Italy LV/SPI

| Function | D1 | D2 | D3 | D4 | Output 1 | Output 2 |
|---|---|---|---|---|---|---|
| No function | 0 | 0 | 0 | 0 | 1 | 1 |
| Remote off | 1# | 0# | 0 | 0 | 1 | 1 |
| Narrow frequency limit. | 0 | 1 | 0 | 0 | 1 | 1 |

#1: Relay is closed, 0: Relay is open.

Country = Germany

| Function | D1 | D2 | D3 | D4 | Output 1 | Output 2 |
|---|---|---|---|---|---|---|
| No function | 0 | 0 | 0 | 0 | 1 | 1 |
| Active power = 0% | 1# | 0# | 0 | 0 | 1 | 1 |
| Active power = 30%. | 0 | 1 | 0 | 0 | 1 | 1 |
| Active power = 60% | 0 | 0 | 1 | 0 | 1 | 1 |
| Active power = 100% | 0 | 0 | 0 | 1 | 1 | 1 |

#1: Relay is closed, 0: Relay is open.